



13 January 2006

Ms. Kasey Ashley
California Regional Water Quality Control Board
North Coast Region
5550 Skylane Boulevard, Suite A
Santa Rosa, California 95403

Subject: Response to Request for Work Plan
Shoreline Development Property
2 T Street, Eureka, California

Dear Ms. Ashley:

On behalf of Shell Oil Company (Shell), this letter responds to the California Regional Water Quality Control Board - North Coast Region (RWQCB) letter dated 21 November 2005 pertaining to the Shoreline Development property, 2T Street, Eureka, California, Case No. 1NHU078. Specifically, the RWQCB requested the following:

- a review of the remedy selection process used for the site Remedial Action Plan (RAP);
- a work plan to evaluate the extent of groundwater impacts in the vicinity of downgradient monitoring well MW-1 and the location of the surface water-groundwater interface; and,
- submittal of an annual groundwater monitoring report.

The groundwater monitoring report is being submitted under separate cover. The RAP review and work plan are provided below, following some introductory background and historical information.



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INTRODUCTION

Site Setting and Uses

The 2.6-acre site is located at 2 T Street, in Eureka, California (Figure 1). On the U.S. Geological Survey (USGS) topographic map, Eureka, CA Quadrangle, the site is located within the northwestern quadrant of Township 5N, Range 1W, Section 23. The Assessors Parcel Numbers (APNs) for the site are APN #2-231-08 and APN #2-231-18¹.

The site is bounded on the north by Humboldt Bay, on the south by Front Street, on the east by a drainage channel, and on the west by open land.

The site was used for bulk storage of petroleum-based solvents and fuels from the late 1920's until approximately 1978. Storage facilities at the site included six above-ground tanks, four 10,000-gallon underground storage tanks (USTs), one 1,000-gallon UST, a 10,000-gallon underground oil/water separator, and an unlined retaining basin located in the northeastern portion of the site² (Figure 2). In 1978, the site ownership transferred to Mr. Lonnie R. Beard. Shell removed the above-ground storage tanks before the property transfer³. From 1978 to 1984, the site was used for equipment storage by Mr. Beard and petroleum product storage by Eureka Oil and Burner. In 1984, Mr. Beard sold the property to Shoreline Development Company (Shoreline). The current site owner is CUE IV, LLC⁴. The site is currently unpaved and vacant.

According to the site owner's representative, SCS Engineers, plans to develop the site are not yet final and are not yet available to the public. However, according to SCS, plans for site development will include the following elements: 1) the majority of the

¹ RWQCB, 1991. "Cleanup and Abatement Order No. 91-28, I.D. No. 1B1HU078NUG." January 25.

² IT Corporation, 2000. "Remedial Action Plan, Former Shell Bulk Fuel Terminal." 15 June.

³ Pacific Environmental Group, 1991. "Former Shell Terminal, 2 T Street at Front Street, Eureka, California." 9 May.

⁴ December 2004. Telephone conversation between Carolyn Kneibler, GeoSyntec Consultants, consultant to Shell Oil Company and Ms. Linda Mackey-Taverner, SCS Engineers, consultant to CUE IV, LLC.

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site will be developed into a park; and, 2) the drainage channel presently on the east site boundary will be expanded via excavation to the approximate configuration shown on Figure 3.

Site Hydrogeology

The site is generally flat with a surface elevation of approximately 10 feet above mean sea level (MSL), sloping gently to the north to Humboldt Bay. Geologic and well construction logs for the site monitoring wells report the uppermost geologic materials at the site are clayey sand, clayey silts, and sandy gravels from ground surface to about 5 feet below ground surface (bgs). A layer of organic clay and peat was encountered in the eastern portion of the site within this uppermost 5 feet. Clays, silts, clayey sands, silty sands, and sands were encountered from 5 feet bgs to depths of about 20 feet bgs.

The current site groundwater monitoring well network consists of six on-site monitoring wells (MW-1, MW-2, MW-3, MW-4, MW-6, and MW-7) and two off-site, upgradient monitoring wells (MW-9 and MW-10) installed in December 1991 and January 1994 (Figure 2). Monitoring wells MW-5 and MW-8 were destroyed during soil excavation activities in 1995. The wells monitor the uppermost groundwater beneath the site, which occurs between 1 foot bgs in the wet season to between 5 and 10 feet bgs in the drier summer and fall. Regional groundwater flow is to the north towards Humboldt Bay.

REVIEW OF REMEDIAL ACTION PLAN (RAP)

Overview of Environmental Investigations and Corrective Actions

Environmental investigations at the site began in November 1988 with two exploratory holes that were dug in preparation for the permitted removal of the four USTs. Evidence of petroleum products was observed in the soil and groundwater, however, the USTs were observed to be intact on removal in August 1989. Additional site characterization investigations followed the UST removal. Table 1 summarizes key site environmental documents and actions since the 1988 discovery.

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Between 1995 and 1997, approximately 10,000 cubic yards (yd³) of hydrocarbon-impacted soil were excavated from 5 areas, treated on-site and then replaced in the excavations together with clean backfill. The areas excavated are shown on Figure 4.

Confirmation soil sample data from the excavations indicated the approved soil cleanup goals were met. Pacific Environmental Group (PEG) calculated the site soil cleanup goals using site specific data to estimate the maximum soil concentrations that could remain in place without causing the site water quality goals to be exceeded at Humboldt Bay and the drainage channel on the east boundary of the site, which were the designated points of exposure. In their letter approving the site-specific cleanup goals⁵, the RWQCB expressed concern about two areas at the site where elevated petroleum hydrocarbons remained in soil, and required groundwater monitoring downgradient of these locations to observe concentrations through time and to evaluate whether natural attenuation was occurring.

According to the site Remedial Action Plan (RAP), the site water quality goals were selected to be protective of the beneficial uses of surface water, specifically the Humboldt Bay and the drainage channel on the east property boundary. The stated groundwater quality goal for total extractable petroleum hydrocarbons (diesel-range hydrocarbons) is 50 micrograms per liter (µg/L). This goal appears to be based on the use of groundwater as drinking water, not for discharge of groundwater to a surface water body. The 21 November 2005 RWQCB letter reiterated that groundwater at this site is designated as a potential drinking water source. However, the approved soil cleanup goals for this site do not appear to take this groundwater use into account. This apparent discrepancy will require resolution.

In the RAP for the site, Shell proposed monitored natural attenuation to address the diesel-range hydrocarbons present in groundwater⁶. In approving the RAP, the RWQCB issued Monitoring & Reporting Program R1-2001-83, which required

⁵ RWQCB, 1996. Letter from Ms. Kasey Ashley to Mr. Frank Fossati and Mr. Donald Murrish. "Shoreline Development, 2 T Street, Eureka, California, Case No. 1THU078". 8 October.

⁶ Pacific Environmental Group, 1999, "Remedial Action Plan," Former Shell Bulk Fuel Terminal, 2 T Street, Eureka, California, Case No. 1THU078, 6 July.



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groundwater monitoring on an annual basis to verify the groundwater remedy for the site⁷.

Assessment of Selected Remedial Actions

The contaminant of concern at this site is total petroleum hydrocarbons as diesel (TPHd). With RWQCB oversight, site characterizations and remedial actions have been implemented. The North Coast Basin Plan includes a policy for the investigation and cleanup of discharges from UST systems. That policy is based on five principals, three of which are listed below:

1. With respect to all underground petroleum tank cases in this Region, the Regional Water Board's highest priority will be to eliminate pollutant sources through tank removal, free product removal, and removal of contaminated soil to the extent practicable. If required, the need for further remedial action will be based on impacts on the beneficial uses of affected waters as determined by reasonable monitoring or other investigation.
2. The Regional Water Board will then assign the highest priority to the resolution of underground petroleum tank cases where drinking water sources are being adversely impacted or are imminently threatened to be adversely impacted.
4. Where practicable, the Regional Water Board will recognize the use of alternative cleanup techniques such as in-situ bioremediation and passive remediation.

With reference to the above, the pollutant source has been eliminated to the extent practicable through tank removal, free product removal, and soil removal. Information obtained to date indicates that the site groundwater is not used and is not geochemically suitable for use as a drinking water resource. North of the site is Humboldt Bay and on the east boundary is a drainage channel. According to the RAP, these surface water

⁷ RWQCB, 2001, "Concurrence with Remedial Action Plan," 30 July.

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bodies are the points of exposure and potential adverse impacts to these water bodies are of concern. Finally, after source removal, the groundwater is being evaluated for whether TPHd in the groundwater is being naturally attenuated.

Based on the foregoing, the selection process for the site remedial actions appears to be appropriate.

WORK PLAN

Overview of Groundwater Monitoring Results

The RWQCB has requested additional investigation at this site due to increased levels of contaminants in groundwater. Before proceeding with developing an action plan, GeoSyntec statistically evaluated the TPHd (with silica gel cleanup) concentrations in monitoring wells MW-1, MW-2, MW-6, and MW-7, which are located in the northern area of the site. Graphs showing TPHd concentrations versus time are provided in Attachment A. No apparent trends are observed in the concentration versus time graphs. GeoSyntec next used a software program from StarPoint Software, ChemStat 3.0, to perform statistical analyses.

The four wells evaluated were installed in 1991 and have been sampled as part of routine monitoring since installation. TPHd data from the ten most-recent sampling events in each well were used in this trend analysis. TPHd results were non-detect (ND) at least once in each data set. The detection limit was used as the result in the statistical analyses for sampling events with ND results.

Data from each well was first tested for normality using the Shapiro-Wilks test, which is the preferred normality test for datasets with less than 50 samples⁸. The Shapiro-Wilks test calculates a W statistic for TPHd in each monitoring well that is then compared to a critical value for the number of samples being tested. If W is greater

⁸ USEPA, 1992. "Statistical Training Course for Ground Water Monitoring Data Analysis." EPA530-R-93-003.

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than the critical value, the data distribution is determined to be normal. ChemStat provides the critical values at 1% and 5% confidence levels. ChemStat calculates the W statistic for the Shapiro-Wilks Test as follows:

$$b = \sum_{i=1}^k [(x_{n-i+1} - x_i) \cdot a_{n-i+1}] = \sum_{i=1}^k b_i$$

where,

n is the number of samples

x_i is the data ordered from smallest to largest

x_{n-i+1} is the data ordered from largest to smallest

k is the greatest integer $\leq n/2$

a_{n-i+1} is the coefficient obtained from Table A-1 [USEPA, 1992]

$$W = \left[\frac{b}{\sigma \sqrt{n-1}} \right]^2$$

where,

σ is the standard deviation

Results of the Shapiro-Wilks test for normality indicate the TPHd data from monitoring wells MW-1, MW-2, and MW-6 is normally distributed at 99% level of significance. The TPHd data from monitoring well MW-7 is not normally distributed (Attachment B1).

Following the Shapiro-Wilks test for normality, trends in intra-well data were evaluated. Because all of the data are not normally distributed, the trends were analyzed using the Seasonal Kendall and Mann-Kendall non-parametric trend analysis methods. The non-parametric trend analyses use only the relative magnitudes of the



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data, rather than their measured values. The Seasonal Kendall trend analysis also tests for seasonality in the evaluation.

Results of the Seasonal Kendall and Mann-Kendall trend analyses indicate the TPHd concentrations in monitoring wells MW-1 and MW-6 are stable (i.e., not exhibiting increasing or decreasing trends). At a 90% confidence level, the TPHd concentrations in MW-2 exhibit no trend; however, at an 80% confidence level, the concentrations appear to be increasing. The TPHd concentrations in monitoring well MW-7 are not stable and do not exhibit an increasing or decreasing trend. The trend analyses worksheets from the Mann-Kendall evaluation are included in Attachment B2. No evidence of seasonality in the data was identified in the Seasonal Kendall analyses.

The TPHd concentrations are stable in two wells and no trends are observed in the other two wells. As presented in the 2005 Annual Groundwater Monitoring Report⁹, TPHd was also detected in upgradient well MW-9 at 67 ug/L. The TPHd concentrations will continue to be evaluated through semi-annual groundwater monitoring of all existing site monitoring wells. Samples will be collected in February (1st Quarter 2006) and August (3rd Quarter 2006). Semi-annual reports will be submitted to the RWQCB by 1 May and 1 November 2006.

In addition to TPHd, the semi-annual groundwater samples will be analyzed for Total Dissolved Solids (TDS) and chloride to help evaluate the overall groundwater quality and to help identify the interface between surface waters (Humboldt Bay and the drainage channel) and groundwater. Field measurements will include salinity, electrical conductivity, and dissolved oxygen.

Extent of Impacts Near MW-1 and Surface Water - Groundwater Interface

The RWQCB requested that Shell investigate the extent of contamination identified in MW-1 and identify the surface water – groundwater interface between Humboldt Bay

⁹ GeoSyntec Consultants, 2006. "Results of December 2005 Groundwater Monitoring Shoreline Development Property, 2 T Street, Eureka, California." 13 January.

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and the site. As discussed above, the statistical analysis of TPHd concentrations do not indicate increasing concentration trends in MW-1 or the other northern wells.

Tidal influence studies were conducted at this site in 1993¹⁰. Four monitoring wells were used in the study: MW-1 nearest Humboldt Bay; MW-4 near the middle of the site; MW-7 closest to the eastern drainage channel; and MW-5 in the southeastern, upgradient area of the site. Results of the three week study indicated that groundwater levels across the site were influenced by tidal changes. The greatest effects were observed in the wells closest to Humboldt Bay (MW-1) and to the drainage channel (MW-7). Although the pressure effects of tidal changes were observed across the site, the zone where groundwater and tidal surface water actually mix together is most likely located close to the shoreline^{11, 12}.

As discussed earlier, conceptual plans for future use of the site include expanding the drainage channel on the east. To investigate TPHd concentrations in groundwater in the vicinity of MW-1 and closer to the shoreline areas, grab groundwater samples will be collected from four locations situated between MW-1 and MW-7 and the shoreline between Humboldt Bay and the drainage channel. Approximate sample locations are shown on Figure 4. The samples will be tested for TPHd, TDS, and chloride. One soil sample from each boring will also be collected and tested for particle size distribution (ASTM-Method D-1140) and triaxial permeability (ASTM Method D-5084) for future tidal dilution modeling of groundwater discharges, if needed.

Reporting

Two semi-annual reports will be submitted to the RWQCB, by 1 May 2006 and 1 November 2006. The reports will describe and present results of the work completed

¹⁰ Pacific Environmental Group, 1994. "Site Assessment and Monitoring Well Installation, Former Shell Oil Company Bulk Plant." 18 February.

¹¹ Westbrook, et al. 2005. "Interaction between shallow groundwater, saline surface water and contaminant discharge at a seasonally and tidally forced estuarine boundary." Journal of Hydrology, 302, pp.255-269.

¹² Thrupp, G. and C. Neville, 2004. "Modeling Tidal Dilution of Groundwater Discharging to Surface Water." California Water and Environmental Modeling Forum Poster Presentation, Monterey. February.



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during the two preceeding calendar quarters. The May semi-annual report will include a description and results of the grab groundwater sampling program. The second semi-annual report will also include an assessment of the site groundwater conditions based on the annual monitoring program and will provide recommendations based on the assessment.

CLOSING

This letter responds to the RWQCB request for additional information and a work plan for additional investigation. In summary:

- The remedy selection process appears to be appropriate and consistent with the principals for petroleum cleanups as stated in the North Coast Basin Plan.
- The TPHd concentrations in groundwater are stable in two monitoring wells and exhibit no trends in the other two wells. The variations in concentrations will be evaluated through continued semi-annual groundwater monitoring of all site monitoring wells to evaluate concentration and groundwater elevation variations through the year. Samples will be collected in February (1st Quarter 2006) and August (3rd Quarter 2006). Semi-annual reports will be submitted by 1 May and 1 November. In addition to TPHd, groundwater samples will be analyzed for TDS and chloride to help evaluate the interface between surface waters and groundwater. Field measurements will include salinity, electrical conductivity, and dissolved oxygen.
- Grab groundwater samples and soil will be collected from four locations situated between MW-1 and MW-7 and the shoreline between Humboldt Bay and the drainage channel. The groundwater samples will be tested for TPHd, TDS, and chloride. The soil samples will be tested for particle size distribution and triaxial permeability for future tidal dilution modeling of groundwater discharges, if needed.



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If you have any questions or comments, please contact Ms. Campagna at (707) 399-7878 or the undersigned at (510) 836-3034.

Sincerely,



Susan H. Skoe, P.E.
Project Engineer



Carolyn Kneibler, C.H.G.
Associate Hydrogeologist

Copy w/attachments to:

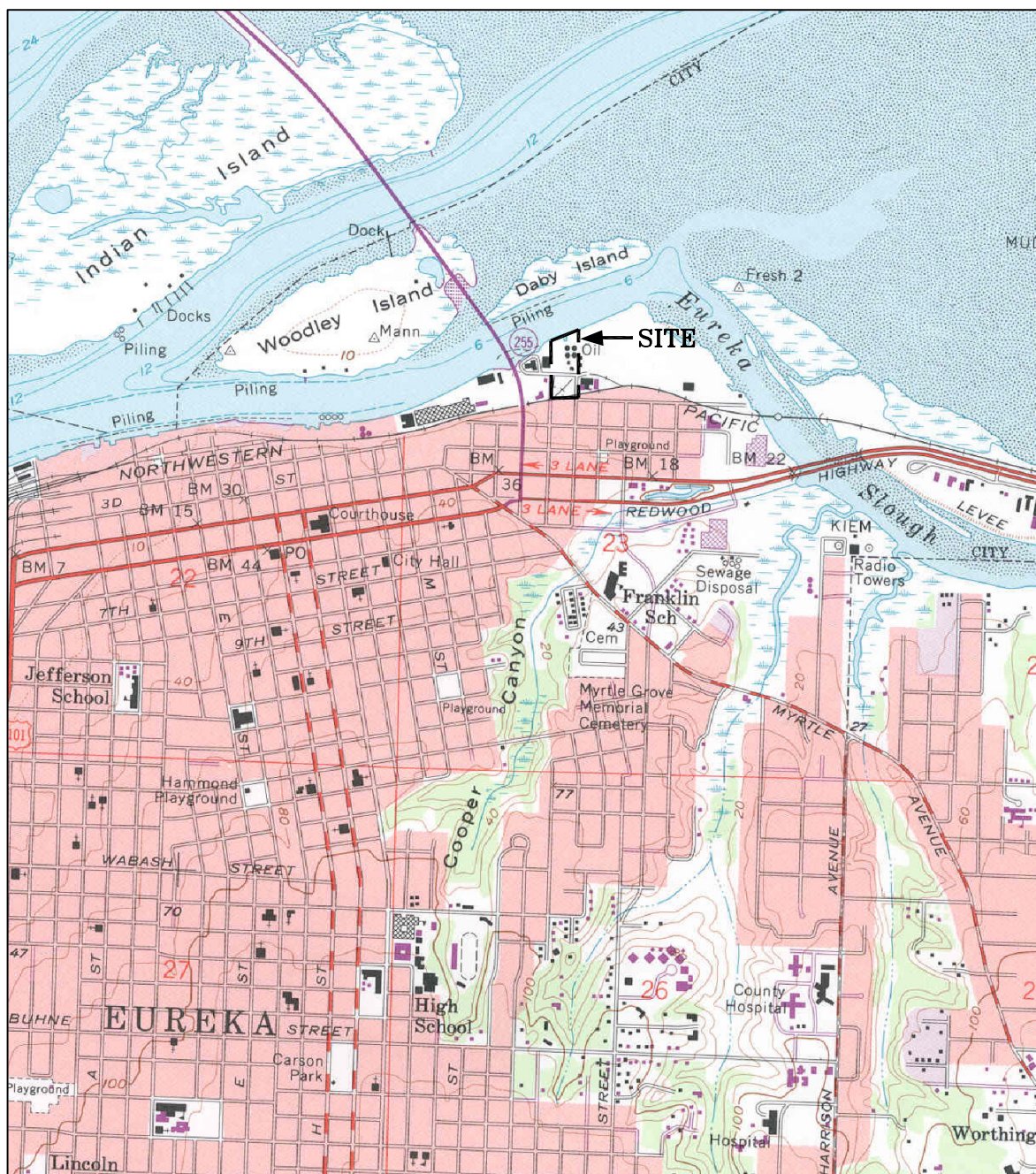
Ms. Carol Campagna, Shell Oil Company
Mr. Fred Griffith, CUE, IV, LLC
Ms. Linda Mackey-Taverner, SCS Engineers

Attachments:

Table 1	Chronology of Key Environmental Actions
Figure 1	Site Location Map
Figure 2	Site Map
Figure 3	Conceptual Plan for Site Development
Figure 4	Site Map Showing Areas of Soil Excavation
Figure 5	Vicinity Topographic Map Showing Proposed Sample Locations
Attachment A	TPHd Concentrations with Time Graphs
Attachment B	Statistical Evaluation

Table 1
Chronology of Key Environmental Actions
Shoreline Development, 2 T Street, Eureka, CA

Date	Activity/Method	Report Date(s)	Consultant/Agency	Comments
1988	Evidence of petroleum release identified in association with removal of 4 USTs.	13 October 1989	Law Engineering	First petroleum evidence obtained from two exploratory borings adjacent to the USTs and reported to Humboldt County in Nov 1988. Seven soil samples and one groundwater sample later collected and tested for the UST closure performed in August 1989.
1991	Cleanup and Abatement Order (CAO) No. 91-28 issued for Shell Oil Company, Lonnie Beard (and Estate), and Shoreline Development Company.	25 January 1991	RWQCB – North Coast Region	CAO required preparation and implementation of a work plan to characterize and cleanup or abate threatened conditions at the site.
1991	Work plan submitted to RWQCB in response to the CAO.	9 May 1991	Pacific Environmental Group (PEG)	
1991	Initial Site Assessment Report – 8 monitoring wells installed; soil samples tested from 13 soil borings and the well borings; well survey.	27 April 1992	PEG	Soil and groundwater impacts identified. One industrial water supply well located upgradient, within ½ mile of the site.
1991 – present	Groundwater monitoring	Various	PEG; IT Corp.; GeoSyntec	Gauging and sampling of site wells. Periodic removal of separate-phase hydrocarbons from Well MW-8. MW-8 and MW-5 destroyed during soil excavation activities in 1995.
1993	Additional site assessment – 2 additional monitoring wells installed; soil samples tested from 12 soil borings; tidal influence study performed; water quality assessment performed.	15 March 1994	PEG	Tidal affects on water levels were observed in monitoring wells across the site. Total dissolved solids and electrical conductivity in northern monitoring wells exceed drinking water source criteria.
1994	CAO No. 94-136 issued to Shell Oil Company, Lonnie Beard (and Estate), and Shoreline Development Company.	14 November 1994	RWQCB	Required Interim Remedial Measures to remediate source areas.
1994	Surface water samples collected from Humboldt Bay and canal east of the site and tested for TPHg, TPHd, and BTEX.	6 January 1995	PEG	All results ND except canal sample collected upgradient of the site.
1995	Work Plan for Interim Remedial Measures	9 January 1995 (Amended 18 January 1995)	PEG	Proposed excavation of five source areas. Stated water quality goals north of MW-4 were based on surface water quality and water quality goals south of MW-4 were based on future beneficial uses of groundwater. Presented soil excavation plan based on technology screening and soil cleanup goals.
1996	Re-Evaluation of Soil Cleanup Levels	1 August 1996	PEG	Soil cleanup objectives re-evaluated based on leachability results and fate & transport modeling to be protective of beneficial uses of surface water.
1996	RWQCB approves: revised soil cleanup levels with reservations stated for two areas (SW-5, 6, 8 and AST-9, 10, 11, 13); and use of treated soils as excavation backfill.	8 October 1996	RWQCB	
1995-97	Soil Excavation and On-Site Treatment	12/20/95, 8/5/96, 8/9/96, 10/1/96, & 4/15/97	PEG	Approximately 10,000 cubic yards of hydrocarbon impacted soil excavated and treated. Soil treated by thermal desorption and ex-situ bioremediation.
1997-98	Backfill of excavations completed	21 November 1997	PEG/IT Corp.	Treated backfill, clean overburden, and clean import fill used as backfill material.
2000	Final Remedial Action Plan (RAP) submitted	15 June 2000	IT Corp.	Final RAP presents feasibility study and corrective action work plan for groundwater. Work plan actions include: annual groundwater monitoring; destroying wells MW-3, -4, -9 and -10; submit site develop plans to RWQCB when available; and manage any site soils and groundwater that may be generated during site development.



Topo Source: U.S.G.S. 7.5 Minute Series,
Eureka, CA Quadrangle (1972)
Contour Interval = 20 ft

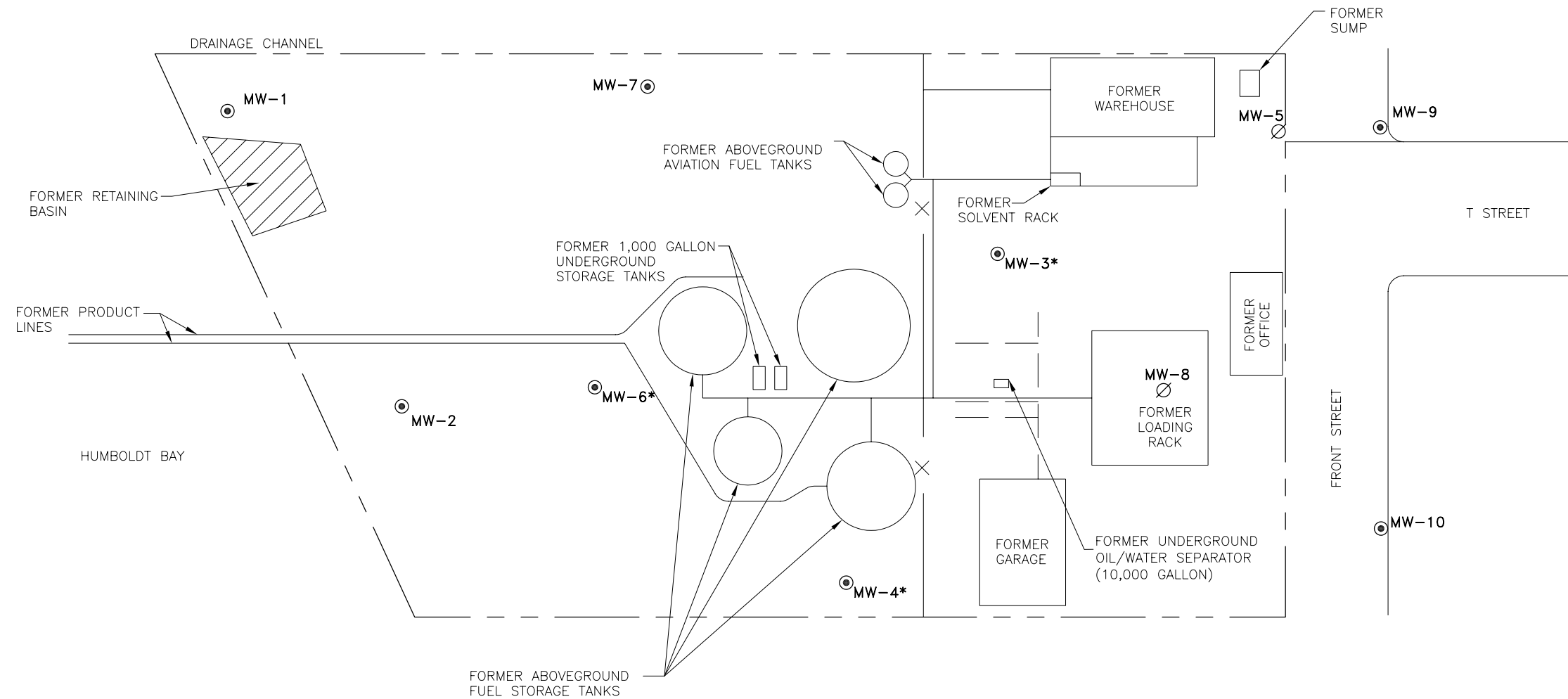
SITE LOCATION MAP
SHELL SHORELINE DEVELOPMENT
EUREKA, CALIFORNIA

0 1000 2000
APPROX.
SCALE IN FEET



GEOSYNTEC CONSULTANTS

FIGURE NO.	1
PROJECT NO.	WR0575
DATE	NOVEMBER_2005
FILE NO.	SITE_LOCATION



LEGEND

- MW-1 ● GROUNDWATER MONITORING WELL (MW-4 LOCATION APPROXIMATE)
- MW-5 ⦿ DESTROYED GROUNDWATER WELL
- * CASING ELEVATION IN DOUBT; WELL NOT USED IN CONTOURING



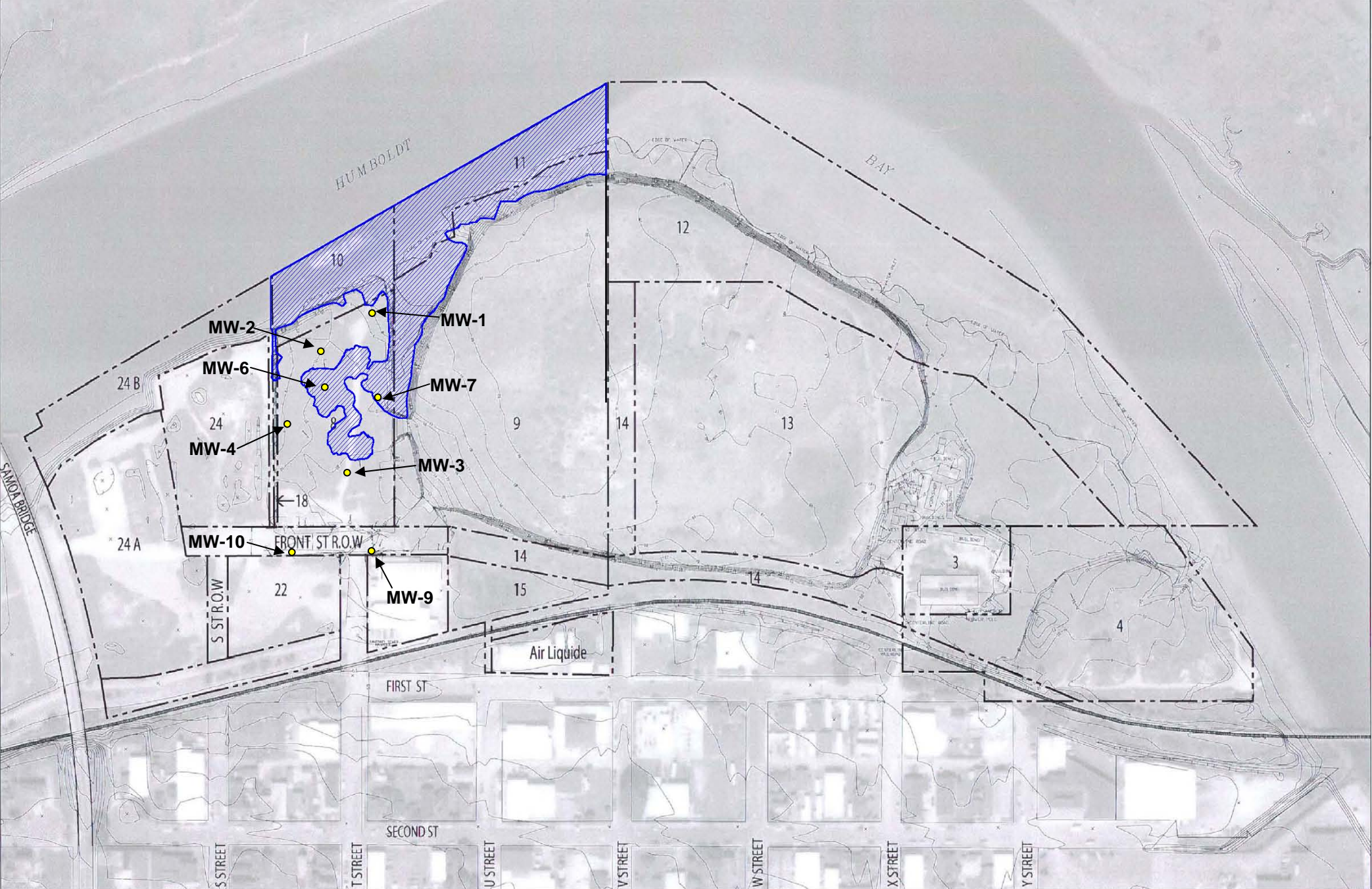
0 30 60
SCALE IN FEET



GEOSYNTEC CONSULTANTS

SITE MAP
SHORELINE DEVELOPMENT PROPERTY
2 T STREET, EUREKA, CALIFORNIA

FIGURE NO. 2
PROJECT NO. WR0575
DATE: 10 JANUARY 2006



EUREKA SHORELINE PROJECT

EUREKA, CALIFORNIA

CUE IV, LLC.
P.O. Box 1028
EUREKA, CA 95502

PARCEL KEY MAP



LEGEND

● ← **MW-2** Approximate Groundwater Monitoring Well Location

CONCEPTUAL DRAWING – DO NOT REPRODUCE



CONCEPTUAL PLAN FOR SITE
DEVELOPMENT

EUREKA SHORELINE PROJECT
EUREKA, CALIFORNIA

Figure Number: 3
Project Number: WR0575
Date: January 2006

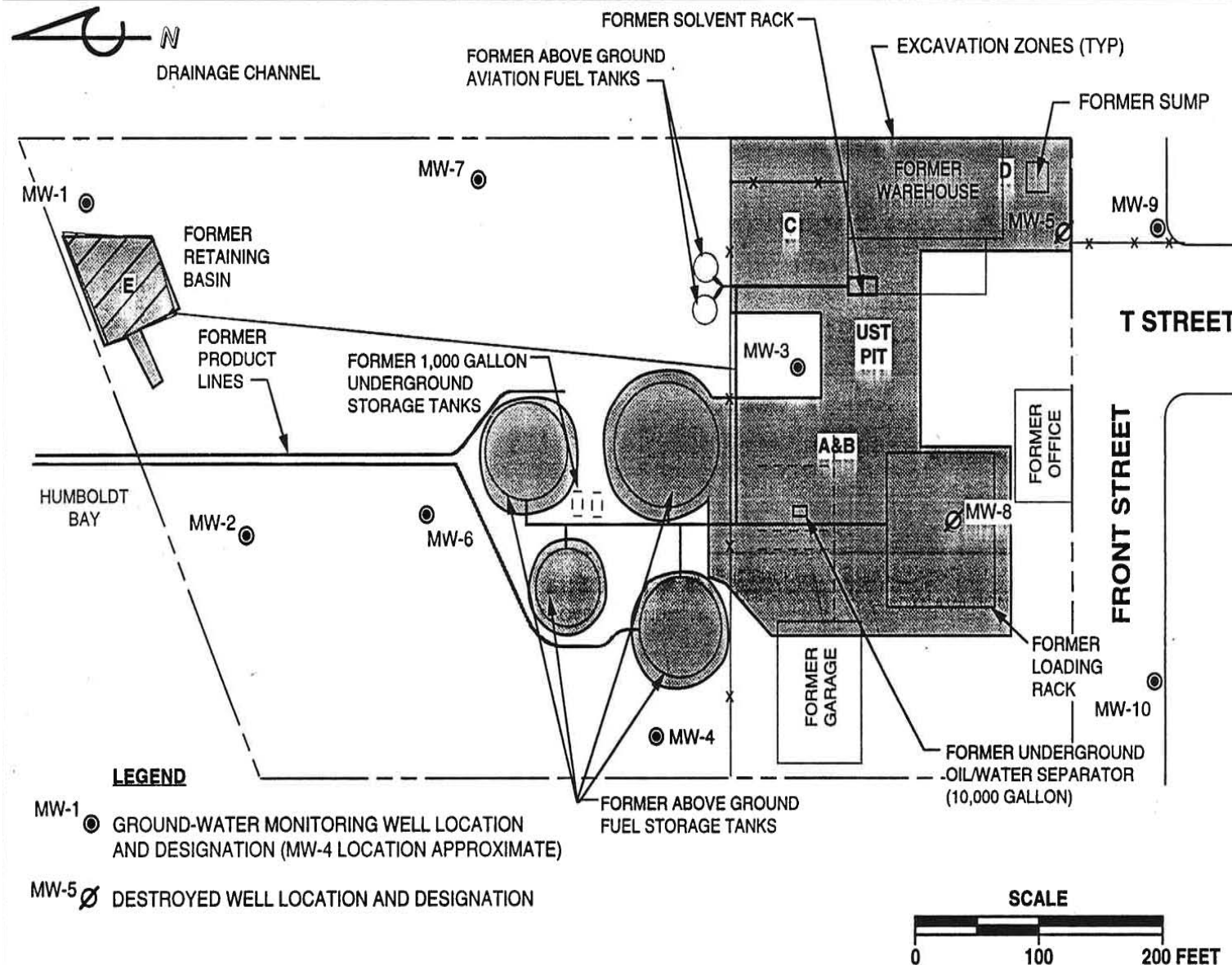


Figure Source: IT Corp


 **GeoSyntec Consultants**

Figure Number: 4

SITE MAP SHOWING AREAS OF SOIL EXCAVATION

Project Number: WR0575

EUREKA SHORELINE PROJECT
EUREKA, CALIFORNIA

Date: January 2006



Legend

- ▲ Proposed Sample Location
- ⊕ Groundwater Monitoring Well



GEOSYNTEC CONSULTANTS

Vicinity Topographic Map Showing
Proposed Sample Locations

SHORELINE DEVELOPMENT
EUREKA, CALIFORNIA

Figure Number:
5

Project Number:
WR0575

Date:
January 2006

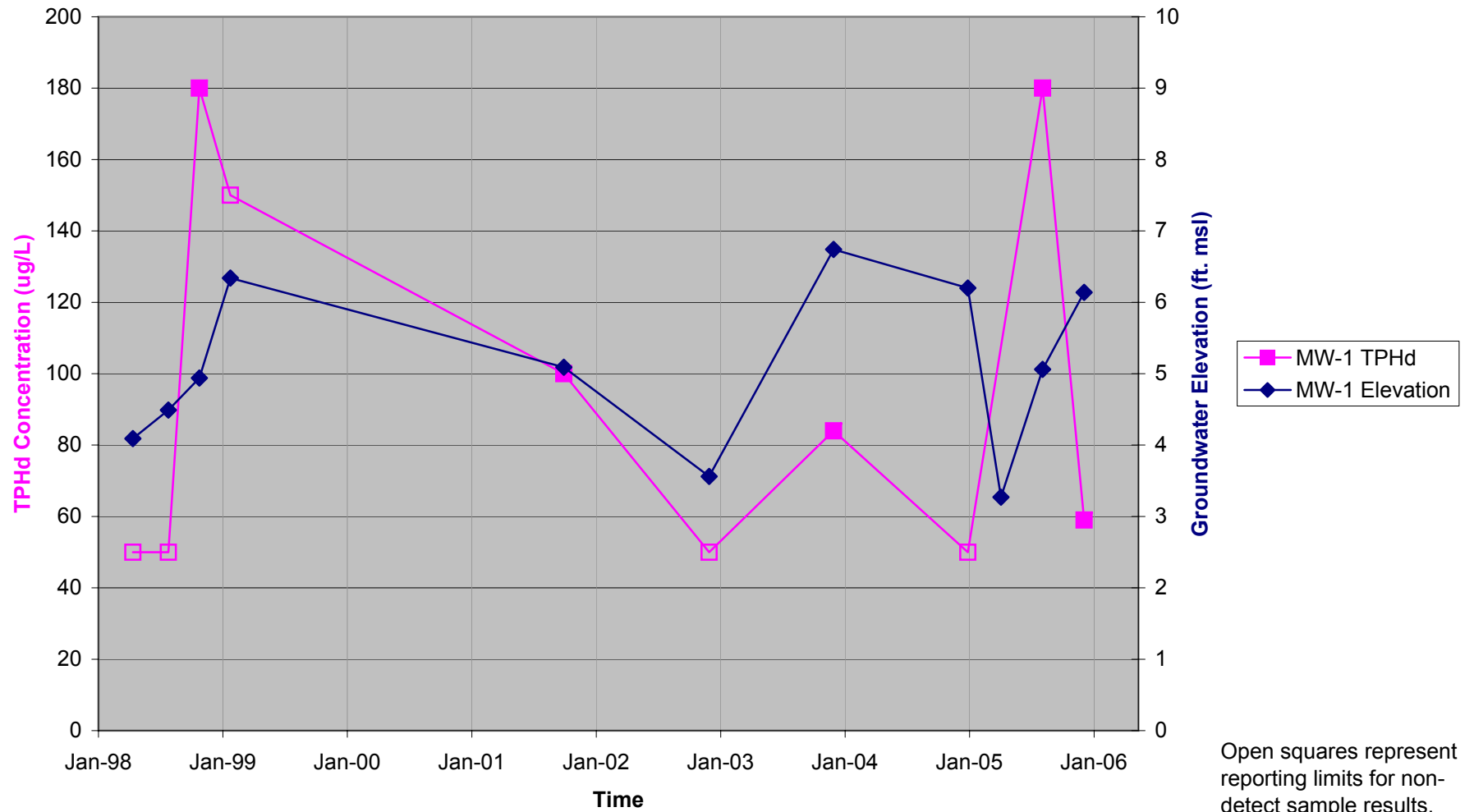
Figure Source: Humboldt County, 2002, Aerial Photography and Topography

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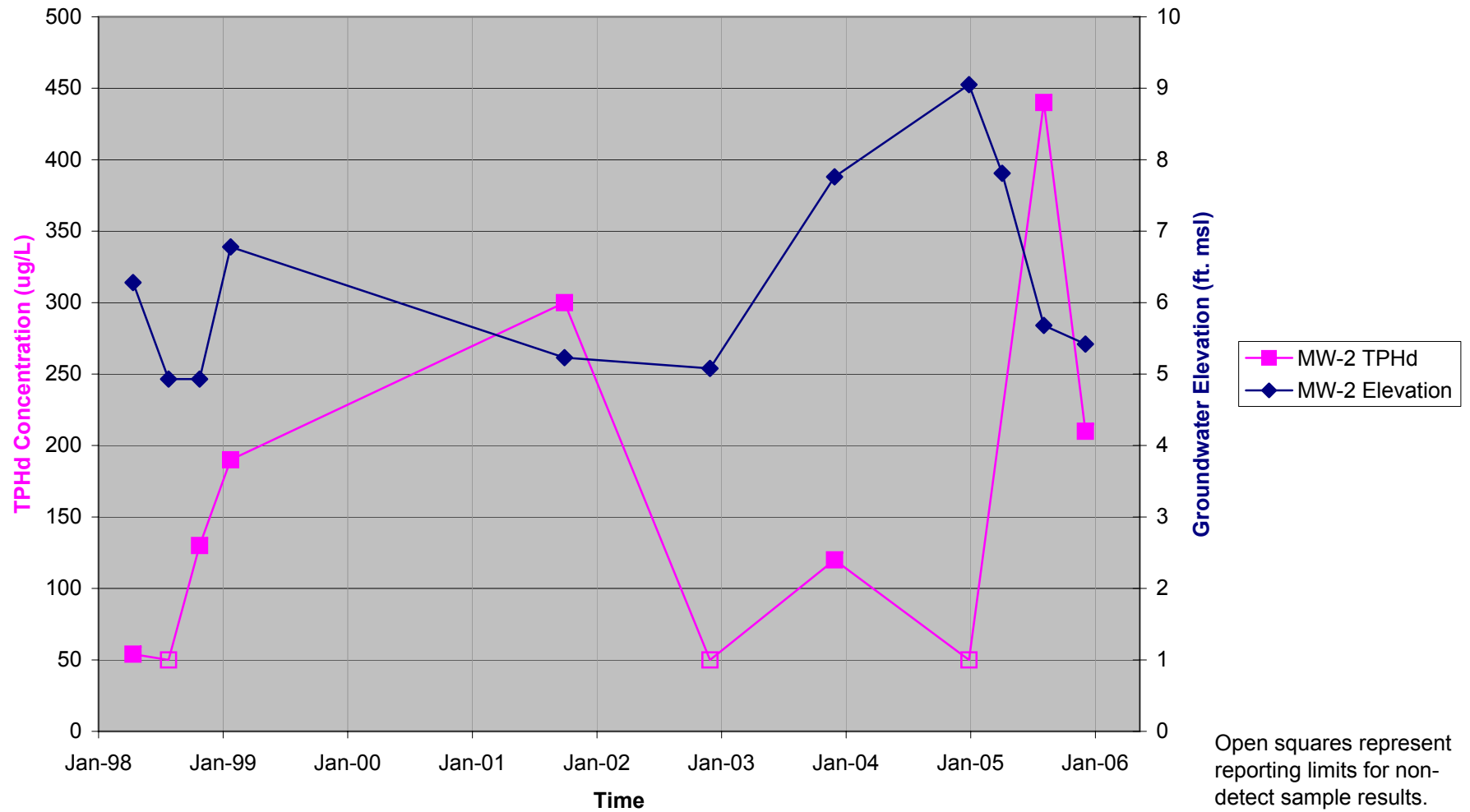
ATTACHMENT A

TPHd Concentration with Time Graphs

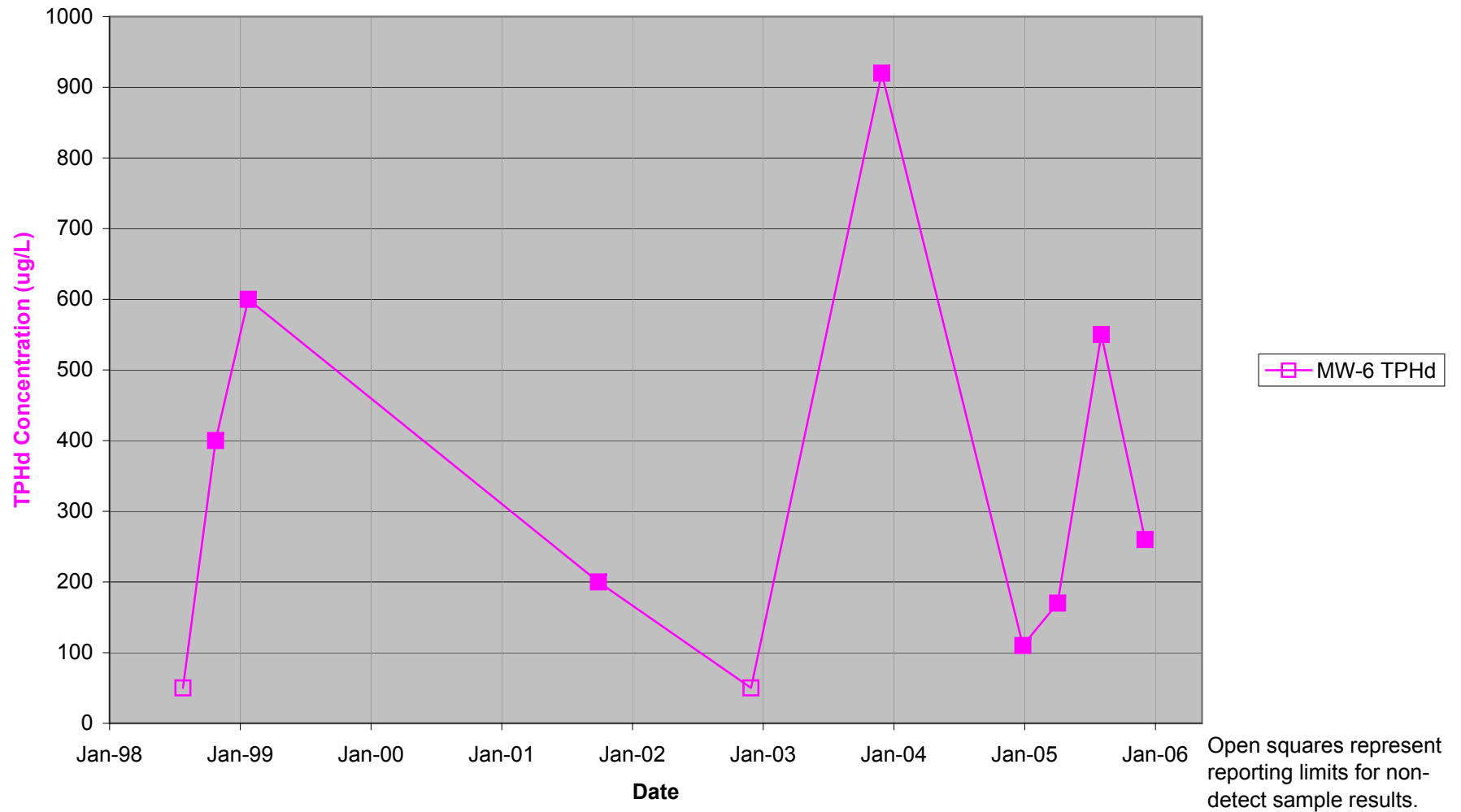
MW-1
TPHd Concentrations and Groundwater Elevations
Shoreline Development, Eureka, CA



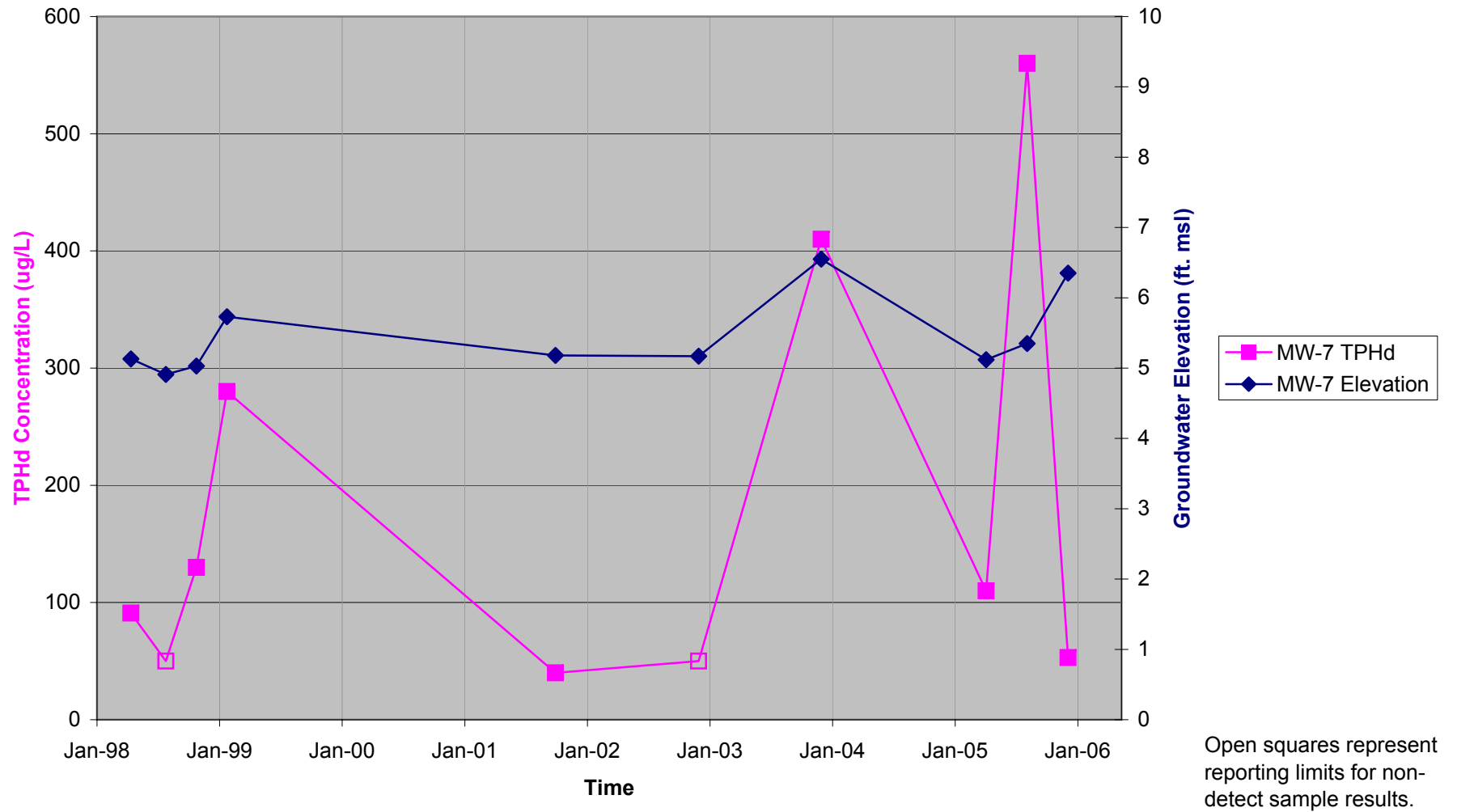
MW-2
TPHd Concentrations and Groundwater Elevations
Shoreline Development, Eureka, CA



MW-6
TPHd Concentrations and Groundwater Elevations
Shoreline Development, Eureka, CA



MW-7
TPHd Concentrations and Groundwater Elevations
Shoreline Development, Eureka, CA



ATTACHMENT B

Statistical Evaluation

Shapiro-Wilks Test of Normality

Parameter: TPHd

Well: MW-1

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

K = 5; Samples = 10

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	50	180	130	0.5739	74.607
2	50	180	130	0.3291	42.783
3	50	150	100	0.2141	21.41
4	50	100	50	0.1224	6.12
5	59	84	25	0.0399	0.9975
6	84	59	-25		
7	100	50	-50		
8	150	50	-100		
9	180	50	-130		
10	180	50	-130		

Sum of b values = 145.918

Sample Standard Deviation = 54.7886

W Statistic = 0.78812

5% Critical value of 0.842 exceeds 0.78812

Evidence of non-normality at 95% level of significance

1% Critical value of 0.781 is less than 0.78812

Data is normally distributed at 99% level of significance

Shapiro-Wilks Test of Normality

Parameter: TPHd

Well: MW-2

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

K = 5; Samples = 10

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	50	440	390	0.5739	223.821
2	50	300	250	0.3291	82.275
3	50	210	160	0.2141	34.256
4	54	190	136	0.1224	16.6464
5	120	130	10	0.0399	0.399
6	130	120	-10		
7	190	54	-136		
8	210	50	-160		
9	300	50	-250		
10	440	50	-390		

Sum of b values = 357.397

Sample Standard Deviation = 129.714

W Statistic = 0.843498

5% Critical value of 0.842 is less than 0.843498

Data is normally distributed at 95% level of significance

1% Critical value of 0.781 is less than 0.843498

Data is normally distributed at 99% level of significance

Shapiro-Wilks Test of Normality

Parameter: TPHd

Well: MW-6

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

K = 5; Samples = 11

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	50	920	870	0.5601	487.287
2	50	600	550	0.3315	182.325
3	110	550	440	0.226	99.44
4	130	400	270	0.1429	38.583
5	170	260	90	0.0395	3.555
6	200	200	0		
7	260	170	-90		
8	400	130	-270		
9	550	110	-440		
10	600	50	-550		
11	920	50	-870		

Sum of b values = 811.19

Sample Standard Deviation = 276.336

W Statistic = 0.861725

5% Critical value of 0.85 is less than 0.861725

Data is normally distributed at 95% level of significance

1% Critical value of 0.792 is less than 0.861725

Data is normally distributed at 99% level of significance

Shapiro-Wilks Test of Normality

Parameter: TPHd

Well: MW-7

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

K = 5; Samples = 10

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	40	560	520	0.5739	298.428
2	50	410	360	0.3291	118.476
3	50	280	230	0.2141	49.243
4	53	130	77	0.1224	9.4248
5	91	110	19	0.0399	0.7581
6	110	91	-19		
7	130	53	-77		
8	280	50	-230		
9	410	50	-360		
10	560	40	-520		

Sum of b values = 476.33

Sample Standard Deviation = 180.149

W Statistic = 0.776802

5% Critical value of 0.842 exceeds 0.776802

Evidence of non-normality at 95% level of significance

1% Critical value of 0.781 exceeds 0.776802

Evidence of non-normality at 99% level of significance

**State of Wisconsin
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Remediation and Redevelopment Program

**Mann-Kendall Statistical Test
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Site Name : Shoreline Development, Eureka, California			BRRTS No. =		Well Number = MW-1	
Compound ->		TPHd				
Event Number	Sampling Date (most recent last)	Concentration (leave blank if no data)	Concentration (leave blank if no data)	Concentration (leave blank if no data)	Concentration (leave blank if no data)	Concentration (leave blank if no data)
1	16-Apr-98	50				
2	29-Jul-98	50				
3	28-Oct-98	180				
4	27-Jan-99	150				
5	1-Oct-01	100				
6	2-Dec-02	50				
7	3-Dec-03	84				
8	29-Dec-04	50				
9	5-Aug-05	180				
10	5-Dec-05	59				
Mann Kendall Statistic (S) =		2.0	0.0	0.0	0.0	0.0
Number of Rounds (n) =		10	0	0	0	0
Average =		95.30	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Standard Deviation =		54.789	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Coefficient of Variation(CV)=		0.575	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Error Check, Blank if No Errors Detected			n<4	n<4	n<4	n<4
Trend ≥ 80% Confidence Level			No Trend	n<4	n<4	n<4
Trend ≥ 90% Confidence Level			No Trend	n<4	n<4	n<4
Stability Test, If No Trend Exists at 80% Confidence Level			CV ≤ 1 STABLE	n<4	n<4	n<4
Data Entry By = SHS			Date = 6-Jan-05	Checked By = CRK		

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Site Name : Shoreline Development, Eureka, California			BRRTS No. =		Well Number = MW-2	
Compound ->		TPHd				
Event Number	Sampling Date (most recent last)	Concentration (leave blank if no data)	Concentration (leave blank if no data)	Concentration (leave blank if no data)	Concentration (leave blank if no data)	Concentration (leave blank if no data)
1	16-Apr-98	54				
2	29-Jul-98	50				
3	28-Oct-98	130				
4	27-Jan-99	190				
5	1-Oct-01	300				
6	2-Dec-02	50				
7	3-Dec-03	120				
8	29-Dec-04	50				
9	5-Aug-05	440				
10	5-Dec-05	210				
Mann Kendall Statistic (S) =		12.0	0.0	0.0	0.0	0.0
Number of Rounds (n) =		10	0	0	0	0
Average =		159.40	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Standard Deviation =		129.714	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Coefficient of Variation(CV)=		0.814	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Error Check, Blank if No Errors Detected			n<4	n<4	n<4	n<4
Trend ≥ 80% Confidence Level		INCREASING	n<4	n<4	n<4	n<4
Trend ≥ 90% Confidence Level		No Trend	n<4	n<4	n<4	n<4
Stability Test, If No Trend Exists at 80% Confidence Level		NA	n<4	n<4	n<4	n<4
Data Entry By = SHS			Date = 6-Jan-05	Checked By = CRK		

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Site Name : Shoreline Development, Eureka, California			BRRTS No. =		Well Number = MW-6	
Compound ->		TPHd				
Event Number	Sampling Date (most recent last)	Concentration (leave blank if no data)	Concentration (leave blank if no data)	Concentration (leave blank if no data)	Concentration (leave blank if no data)	Concentration (leave blank if no data)
1	29-Jul-98	50				
2	28-Oct-98	400				
3	27-Jan-99	600				
4	1-Oct-01	200				
5	2-Dec-02	50				
6	3-Dec-03	920				
7	29-Dec-04	110				
8	5-Apr-05	170				
9	5-Aug-05	550				
10	5-Dec-05	260				
Mann Kendall Statistic (S) =		6.0	0.0	0.0	0.0	0.0
Number of Rounds (n) =		10	0	0	0	0
Average =		331.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Standard Deviation =		284.193	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Coefficient of Variation(CV)=		0.859	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Error Check, Blank if No Errors Detected			n<4	n<4	n<4	n<4
Trend ≥ 80% Confidence Level			No Trend	n<4	n<4	n<4
Trend ≥ 90% Confidence Level			No Trend	n<4	n<4	n<4
Stability Test, If No Trend Exists at 80% Confidence Level			CV ≤ 1 STABLE	n<4	n<4	n<4
Data Entry By = SHS			Date = 6-Jan-05	Checked By = CRK		

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Site Name : Shoreline Development, Eureka, California			BRRTS No. =		Well Number = MW-7	
Compound ->		TPHd				
Event Number	Sampling Date (most recent last)	Concentration (leave blank if no data)	Concentration (leave blank if no data)	Concentration (leave blank if no data)	Concentration (leave blank if no data)	Concentration (leave blank if no data)
1	16-Apr-98	91				
2	29-Jul-98	50				
3	28-Oct-98	130				
4	27-Jan-99	280				
5	1-Oct-01	40				
6	2-Dec-02	50				
7	3-Dec-03	410				
8	5-Apr-05	110				
9	5-Aug-05	560				
10	5-Dec-05	53				
Mann Kendall Statistic (S) =		10.0	0.0	0.0	0.0	0.0
Number of Rounds (n) =		10	0	0	0	0
Average =		177.40	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Standard Deviation =		180.149	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Coefficient of Variation(CV)=		1.015	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Error Check, Blank if No Errors Detected			n<4	n<4	n<4	n<4
Trend ≥ 80% Confidence Level			No Trend	n<4	n<4	n<4
Trend ≥ 90% Confidence Level			No Trend	n<4	n<4	n<4
Stability Test, If No Trend Exists at 80% Confidence Level			CV > 1 NON-STABLE	n<4	n<4	n<4
Data Entry By = SHS			Date = 6-Jan-05	Checked By = CRK		